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This curriculum guide was developed by the Alaska State Department of Education for the purpose of aiding elementary and secondary school teachers in incorporating elements of aerospace science in the classroom. The section of the guide designed for elementary school teachers includes chapters under the headings: Aircraft, Airports, Weather, Rockets, Missiles, Satellites, Astronauts, Survival, Unidentified Flying Objects, Careers, and History of Aviation. The section designed for use by secondary school teachers includes: History of Aviation and Space Exploration, Vehicles, Physical Factors, and Socioeconomic Factors. Under each topic for elementary teachers, there is a list of suggested activities and a teaching aids bibliography that cites filmstrips, films, teacher's manuals, and books that can be useful to the teacher. The section of the guide for secondary school teachers provides a framework for a general aerospace course. This publication has a list of aerospace periodicals and a list of sources of aerospace educational materials. (BR)

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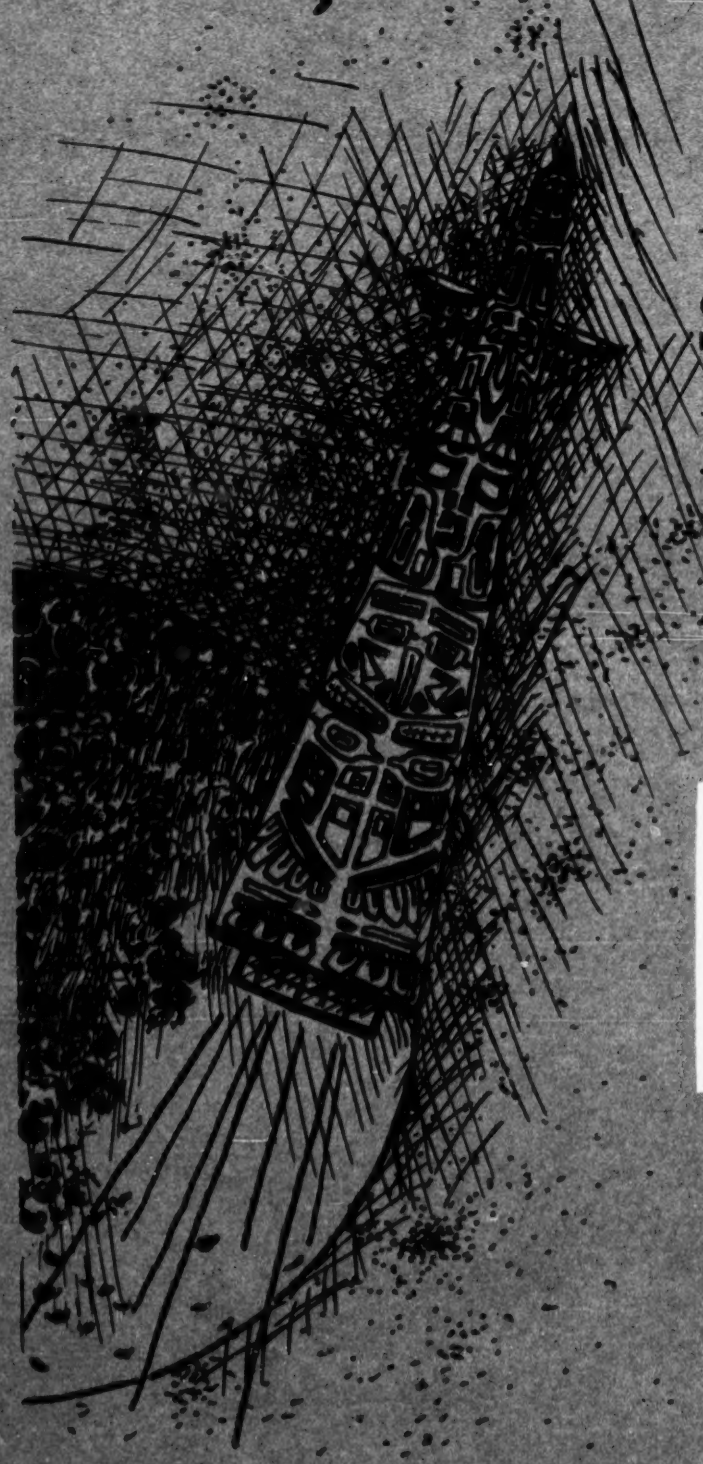

AEROSPACE SCIENCE EDUCATION

A Curriculum Guide

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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FOREWORD

AEROSPACE EDUCATION

Aerospace is an integral part of the social, economic and cultural environment of today's generation and, from all indications, shall increase in importance. Students need to develop new concepts of distance, size, time, direction and motion while at the same time redefining their earth-oriented language so that it has new meaning for use in the Space Age. Meaningful experiences that will produce a better understanding of aerospace by the young people in the schools of Alaska are both desirable and essential. The principles and concepts of aerospace may be integrated into the existing curricular areas where it is deemed desirable by the school system and/ or a separate curricular area may be developed.

Aerospace Education is interdisciplinary in nature including the arts, the humanities, and the sciences - although the primary study of aerospace is concerned with aircraft and spacecraft the secondary effects of aerospace involves the daily cultural, social, and economic lives of people not directly connected with the aerospace industry.

Aerospace reveals the problems and potential presented by the removal of the distance barrier which then places humans in a close proximity to one another. In addition, although the social implications resulting from present and future aerospace developments cannot at this time be adequately envisioned, an awareness of such implications must become a part of today's Alaskan student's education. The Aerospace Handbook is aimed at achieving this end.

Aerospace Education is where the action is! The exciting developments in the area of aerospace provide a natural vehicle for the stimulation of the student toward intellectual activities. Unlocking their dynamic energies and directing them toward such activities should result in an individual equipped with knowledge and a disciplined mind which are needed to cope with constantly changing life situations. This in turn should result in attitudes contributing to a higher degree of personal integrity, self reliance, self discipline, and better habits of orderliness and precision, citizenship, and a fuller respect for constituted authority.

This document has been prepared as a broad guide to provide schools with the information about resources whereby they may develop a program of studies to meet the needs of their communities within the aerospace area. The Alaska Aerospace Committee is available and eager to provide aid and assistance to any school system that requests consultive help through the State Department of Education.

Dr. Clifford Hartman
Commissioner of Education

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INTRODUCTION

From bush to metropolis, aerospace has been an integral part of the lives of Alaskans. Our state currently has more licensed pilots and small aircraft per capita than any place else in the world. Commercial airlines and military air traffic play an important part in the state's transportation and economic structure. The vital role of aerospace to Alaskans is expected to grow. Our understanding of this industry must increase.

The following guide has been developed to aid the interested teacher in incorporating elements of aerospace into the classroom. There is no special order to the areas described, nor are any portions considered all-important or unimportant. Teachers may start where they wish, include those areas of interest, affiliate the ideas and concepts into any established curricular program area, or follow the guide and teach aerospace units.

The important thing is to recognize we are living in the "now generation", and the "now kid" can be stimulated and challenged by this exciting area. The State Aerospace Committee is interested in helping you "get involved" in whether or not you can recognize a wing from a prop. Deep involvement in aerospace and expensive materials are not necessary to the success of this program. Many free, and low-cost materials are available from both government and private agencies. A small investment in a membership to the National Aerospace Education Council or the National Aerospace Education Association may start an interest you never thought you had.

The bibliography indicates sources of information, packets, pamphlets films, and other resources for aerospace. Once you become involved, you will probably find this guide more than adequate, if not, request assistance from the State Aerospace Education Council through the State Department of Education.

ELEMENTARY TEACHERS START HERE

Aerospace is for you! The air age is here and the students are eager because they are part of this age and the future. There is no special order for teaching about this subject anymore than there is a set pattern to stimulate students.

This is only a guide to be used as a starter and to provide information on where to begin and some ways to proceed. Add areas of your own, choosing after you get your feet on the ground - kids love it. A motivated teacher will stimulate many students. The total program is important, and you don't have to leave out the three R's to include aerospace as it is a natural in any subject area.

ELEMENTARY AEROSPACE GUIDELINES

CONCEPTS AND ACTIVITIES
Elementary Grades K-6

I. AIRCRAFT

A. The child should be able to:

1. Identify from pictures the types of aircraft
   a. fixed wing
   b. rotary wing
   c. gliders

2. Point out on a model the structure of an airplane
   a. fuselage
   b. wings
   c. engine
   d. tail
   e. handling gear

3. Describe the basic flight instruments, and explain their use to a pilot
   a. airspeed indicator
   b. compass
   c. altimeter
   d. turn and bank

4. Demonstrate on a model the functions of the controls on an airplane. Show the roll, pitch and yaw attitudes of an aircraft.
   a. roll-ailerons
   b. pitch-elevators
   c. yaw-rudder

5. Demonstrate the meaning of
   a. lift-wing
   b. thrust-power
   c. drag-resistance
   d. gravity-weight

6. Identify engines used to obtain flight
   a. piston
   b. jet

7. List uses of airplanes, helicopters and jets in the present day world of aviation.

B. Suggested Activities

1. Visit an airport to observe the parts of a plane or a helicopter.

2. Construct balsa wood models and label all parts.

3. Construct and fly paper models (put on elevators, rudders, ailerons) to show principles of flight.

4. Collect for bulletin board display various types of aircraft. Identify each with paper labels.

5. Demonstrate principles of lift (Bernoulli's Law) with Ping-Pong balls and a jet stream of air.

6. Draw an instrument panel and label primary gauges used for flight.

7. Fly balsa wood models with varied pitched propellers to show degrees of thrust produced.

8. Observe action and reaction principle by building a jet propelled boat with milk carton, balloon and a straw.

9. Make a list of uses for helicopters and planes with illustrations.

10. Arrange a silhouette exhibit of all types of aircraft.

11. Prepare wrirten reports on the uses of commercial planes. Illustrate each report with a drawing or painting.

12. Make a chart showing military, commercial and private airplanes, indicating the use of each type.

13. Recognize sonic booms when jets break sound barrier.

C. Teaching Aids Bibliography

Filmstrips

a. Airports and Your Community--United Airlines

b. Controlling Airplanes--McGraw-Hill Text-Film
c. How Do Helicopters Fly?--Jam Handy
d. How Do Jets Fly?--Jam Handy
e. How Is An Airplane Controlled?--Jam Handy
f. What Makes An Airplane Fly?--Jam Handy

2. Films 16 MM
   a. Airplanes: Principles of Flight--Cornet Films, color, 11 min.
   b. Approaching the Speed of Sound--Shell Oil, color, 27 min.
   c. Birth of a Helicopter--Sikorsky Aircraft Division, color, 23 min.
   d. Fred and Billy Take an Airplane Trip--FAA Film, 11 min.
   e. History of the Helicopter--Shell Oil, b/w, 20 min.
   f. How an Airplane Flies (six films)--Shell Oil, b/w, 59 min.
   g. Jet Propulsion--Encyclopedia Britannica, color, 13, min.
   h. Up and Over (Uses of a helicop ter)--Sikorsky, color, 12 min.

3. Teachers' Manuals
   a. Strickler, Mervin K. Jr., An Introduction to Aerospace Education Chicago: New Horizons Publishing Co. Inc., 1968
   b. Federal Aviation Agency: Demonstration Aids for Aviation (Washington: Government Printing Office, 1965)
   c. Oths, Florence V., Teaching to Meet the Challenge of the Space Age. NASA (Washington: Government Printing Office, 1963)
   d. Cessna Aircraft Company: Air Age Educational Material for Elementary Teachers. (Wichita, Kansas, 1968)

4. Books
   a. Brenner, Anita. I Want To Fly. Hale Cadmus, 1958
   b. Bryan, Leslie A. Fundamentals of Aviation. Institute of Aviation. University of Illinois
   c. Colby, Carroll B. Air Drop. Coward, 1959
   d. Davis, Clive E. Junior Airman's Book of Airplanes. Dodd, 1958
   e. Deleeuw, Adele. Story of Amelia Earhart. Grosset, 1955
   f. Feravolo, Rocco. Junior Science Book of Flying. Garrard, 1960
   g. Gilmore, H. H. Model Airplanes for Beginners. Harper, 1964
   h. Gottlieb, William P. Aircraft and How They Work. Doubleday, 1960
   i. Highland, Harold. How and Why Wonder Book of Flight. Grossett, 1962
   j. Lewellen, John. The True Book of Airports and Airplanes.
   k. Loomis, Robert D. All About Aviation. Random House, 1964
   l. Post, Wiley, Around the World in Eighty Days. McNally, 1931
   m. Pacillio, James V. Discovering Aerospace. Children's Press, 1965
   n. Toland, John. Flying Tigers. Random House, 1963

II. AIRPORTS

A. The pupil should be able to:

1. Tell the various functions of an airport
    a. flight plans
    b. weather information
    c. refueling
    d. maintenance
    e. passenger accommodations

2. Explain the terminology connected with airports
    a. control towers
    b. runways
    c. hangars
    d. terminals
    e. ramps
    f. beacons
    g. lighting
    h. FAA facilities

B. Suggested Activities

1. Visit an airport to observe the facilities pertinent to flight

2. Construct a model airport labeling all parts.

C. Teaching Aids Bibliography

1. Filmstrips
    a. The Airport and Your Community--United Airlines
    b. Airports and Airplanes--Society for Visual Education
    c. Science at the Airport--McGraw-Hill Film-Texts
    d. Jet Age Flight--Society for Visual Education

2. Films 16 MM
    a. Airport, The--Encyclopedia Britannica Films
    b. Busy Airport, The--Cornet Films, 11 min.
    c. Behind the Scenes at the Airport--Carl F. Manke Productions
    215 E. 3rd St., Des Moines, Iowa

3. Books
   a. Bowen, Robert S. Airport, Our Link to the Sky. Whitman, 1962.
   b. Colonius, Lillian. The Airport. Melmont, 1953.
   c. Lewellen, John. The True Book of Airports and Airplanes, Children's Press, 1956.
   d. Stuart, Marrie. About the Airport and the Airplane. Harvey, 1964.

III. WEATHER

A. The Pupil should be able to:

1. Understand principles of weather and how they affect flying.
   a. explain what causes air to move
   b. air masses
   c. cold fronts
   d. stationary fronts
   e. fogs
   f. rain
   g. snow
   h. changes in air pressure and cloud formations

2. Read weather gauges
   a. thermometer
   b. barometer
   c. anemometer
   d. hygrometer
   e. wind vane
   f. rain gauge

B. Suggested Activities

1. Construct a rain gauge, barometer, anemometer and weather vane.

2. Chart the weather for a month using weather symbols. Record precipitation, air pressure, air temperature, humidity, wind direction and speed, sky condition and types of clouds.

3. Illustrate the various cloud formations with construction paper.
   a. cumulus
   b. nimbus
   c. cirrus
   d. stratus

4. Visit an FAA weather station at the airport to determine how pilots receive weather reports.

5. Forecast the weather for one week.

C. Teaching Aids Bibliography

1. Filmstrips
   a. Air Around Us--Society for Visual Education
   b. Air Masses and Weather Fronts--Society for Visual Education
   c. How to Forecast the Weather--Society for Visual Education
   d. Safety in Flight--Jam Handy
   e. Visit to A Weather Station--Eyegate House
   f. Weather Changes and Their Causes--Society for Visual Education
   g. What is Weather?--Jam Handy
   h. What Makes Weather?--Jam Handy
   i. Why Does It Rain, Snow, Hail and Sleet?--Society for Visual Education

2. Films
   a. How Weather is Forecast--Cornet Films, 11 min.
   b. Let's Learn to Predict Weather--Cornet Films, 11 min.

3. Books
   a. Barr, Jene. Dan the Weatherman. Whitman 1958
   b. Barr, Jene and Chapin, Cynthia. What Will the Weather Be? Whitman, 1959
   c. Gallant, Roy A. Exploring the Weather. Garden City, 1957
   d. Gibson, Gertrude. About Our Weather. Children's Press. 1960
   e. Wolfe, Louis. Probing the Atmosphere. The Story of Meteorology. Putnam, 1961

4. Miscellaneous Teacher Aids
   a. Aviation Units for the Intermediate Grades--National Aerospace Education Council. Includes units on the airport, weather, and principles of flight.
   b. Aviation Units for the Primary grades--National Aerospace Education Council. Includes units on the airport and general overview of aviation.

IV. ROCKETS

A. The pupils should be able to:

1. Explain how a rocket engine develops thrust

a. stages
b. fuels

2. Display a basic understanding of the history of rocketry from the 13th Century to the present.

3. Apply Newton's Third Law of motion in the launching of a rocket.

4. Demonstrate principles of a gyroscope and its application to rocket guidance systems.

B. Suggested Activities

1. Build and launch a rocket made with a CO_2 cartridge or compressed air (balloon).

2. Build commercial models of rockets illustrating the different stages

3. Collect pictures of the different kinds of rockets.

4. Write a report about Robert Goddard or Wernher Von Braun.

5. Visit local defense installations on Armed Forces Day to see the Nike Missile.

C. Teaching Aids Bibliography

1. Filmstrips
   a. Rockets to Space--Jam Handy
   b. Pioneers of Space--Eyegate House

2. Films
   a. Before Saturn--NASA, color, 15 min.
   b. Father of the Space Age--NASA, b/w, 18 min.
   c. History of Development of Rockets--McGraw-Hill Films, 16 min.
   d. Man in Flight--Walt Disney, color, 31 min.
   e. Missiles, Rockets and Staellites--NASA, color, 27 min.
   f. Rockets: How They Work--Encyclopedia Britannica Films, color, 16 min.
   g. X-15 Documentary--NASA, color, 27 min.

3. Books
    a. Bergaust, Erik. Rocket Aircraft, USA. Putnam, 1961
    b. Caidin, Martin. X-15 Man's Daring Flight Into Space. Ridge, 1961
    c. Chester, Michael. Let's Go to A Rocket Base. Putnam, 1961
    d. Cox, Donald and Stoiko, Michael. Rocketry Through the Ages. Holt, Rinehart and Winston, 1959
    e. Del Ray,Lester. Rockets Through Space. Holt, Rinehart and Winston, 1960
    f. Robert Goddard: Father of Modern Rocketry. National Aeronautics Education Council
    g. Shelton, William Roy. Countdown: The Story of Cape Kennedy, 1960
    h. Von Braun, Wernher and Ordway, Frederick I., III. History of Rocketry and Space Travel. Crowell, 1966

V. MISSILES

A. Pupils should be able to:

1. Categorize the missiles according to their use
    a. surface to surface
    b. surface to air
    c. air to air

2. Understand that missiles may be controlled automatically or by ground control.

B. Suggested Activities

1. Collect and mount pictures of missiles. Label with name and category.

2. Construct plastic models of missiles.

3. Visit local defense installations on Armed Forces Day to see the Nike Missile.

C. Teaching Aids Bibliography

1. Filmstrips
    a. The Thor Missile--Associated Films, b/w, 30 min.

2. Films, 16 MM
    a. Guided Missile--Associated Films, b/w, 30 min.
    b. Minuteman--Associated Films, b/w, 30 min.
    c. Minuteman--Missile and Mission--Thiokol Chemical Corp., 20 min.
    d. Missile Named MAC--Bell Telephone, color, 8 min.
    e. Pacific Missile Range--U.S. Navy, color, 14 1/2 min.
    f. T-Minus Two Hours--Thiokol Chemical Corp., color, 26 min.

3. Books
    a. Knight, Clayton. Rockets, Missiles and Satellites Grossett, 1958
    b. Parker, Bertha Morris. Rockets and Missiles. Row Peterson, 1961

VI. SATELLITES

A. The pupil should be able to:

1. Explain why a satellite stays in orbit

2. List the information that is received from satellites

B. Suggested Activities

1. Collect pictures of space satellites and explain their function

2. Construct plastic models of Mercury, Gemini, and Apollo space craft

3. Collect and mount news items about satellites

C. Teaching Aids Bibliography

1. Filmstrips
    a. Information From Satellites--McGraw Hill
    b. Space Satellites--Jam Handy
    c. What Are Satellites?--Jam Handy

2. Films
    a. Orbiting Solar Observatory--NASA, color, 27 min.
    b. Satellites That Talk--Associated Films, b/w, 30 min.
    c. Telstar--Bell Telephone, color, 27 min.
    d. Tiros, Experimental Weather Satellite--NASA
    e. Weather Satellites--Encyclopedia Britannica, color, 15 min.

3. National Aeronautics and Space Administration pamphlets
    a. Tiros
    b. Pioneer V
    c. Explorer
    d. Orbiting Solar Observatory
    e. Orbiting Geophysical Observatory
    f. Biosatellites

4. Miscellaneous Material
    a. Ortleb and Cadice. The Solar System and Space Travel. St. Louis, Mo., Millikan Publishing Co. A transparency duplicating book.

5. Books
    a. Asimov, Isaac. Satellites in Outer Space. Random, 1960
    b. Dietz, David. All About Satellites and Space Ships, Random, 1958
    c. Newell, Homer E. Guide to Rockets, Missiles and Satellites. Whittlesay House, 1958
    d. Taylor, John W. R. Rockets and Satellites Work Like This. Roy, 1959

VII. ASTRONAUTS

A. The pupils should be able to:

1. Understand that an astronaut must be physically fit and must receive extensive training for space flights.

2. Understand that an astronaut can survive in space if he has an environment similar to earth's.

3. Understand that problems of G-forces, weightlessness and cosmic rays must be overcome.

4. Show how the space suit is of vital importance in flights.

5. Explain that foods taken into space must be specially treated.

B. Suggested Activities

1. Read about the training an astronaut must take in preparation for space flights. Prepare an oral report.

2. Make a pictorial time line of American astronauts' flights and their space capsules.

3. Collect news items on the current space flights.

C. Teaching Aids Bibliography

1. Filmstrips
   a. Hazards in Space Travel. Eyegate House
   b. Man In Space. Encyclopedia Britannica
   c. Man In Space. Society for Visual Education
   d. Man Travels In Space. Eyegate House
   e. Man's Preparation for Space Travel. Jam Handy
   f. Project Apollo-Manned Flight to the Moon. NASA

2. Films 16 MM
   a. Apollo, Lunar Mission Profile. NASA, color, 31 min.
   b. Four Days of Gemini 4. NASA, color, 27 min.
   c. Gemini: The Twins. NASA, color, 14 min.
   d. Manned Space Flight. NASA, color, 14 min.
   e. Moon Exploration. Douglas Aircraft, color, 30 min.
   f. Living In Space. NASA. color, 12 min.
   g. Suited For Space. NASA. color, 28 min.

3. Books
   a. Bergaust, Eric. Illustrated Space Encyclopedia. Putnam, 1965
   b. Greene, Carla. I Want To Be A Space Pilot. Children's Press, 1961
   c. Kay, Terence. Space Volunteers. Harper, 1960
   d. Lent, Henry B. Man Alive In Outer Space. MacMillan, 1961
   e. Ley, Willy. Man In Space. Singer, 1959
   f. May, Julian. Show Me the World of Space Travel. Pennington, 1959
   g. Myrus, Don. The Astronauts: The True Story of Man's Greatest Adventure in Outer Space. Grosset, 1961

VIII. SURVIVAL

A. The child should be able to:

1. Identify foods which are in his immediate environment which could be eaten if he were left to his own resources.

2. Recognize symptoms of frost bite

3. Construct an emergency shelter

B. Suggested Activities

1. Make a list of foods from land and sea which could be used in an emergency.

2. Read and report to class how frost bite should be treated.

C. Teaching Aids Bibliography

1. Films 16 MM
   a. Safety in Winter. State of Alaska Regional Film Library, color, 11 min.
   b. First Aid: Fundamentals. State of Alaska Regional Film Library, color, 11 min.

2. Books
   a. Angier, Bradford, Vena Angier. Living Off the Country: How to Stay Alive in the Woods. Stackpole 1963
   b. Bendick, Jeanne. The Emergency Book. Rand McNally, 1967
   c. Colby, C. B. Survival: Training in Our Armed Services. Coward McCann, 1965
   d. Heller, Christine A. Wild Edible and Poisonous Plants of Alaska. University of Alaska Cooperative Extension Service, United States Department of Agriculture. Publication No. 40. Washington: Government Printing Office, 1966
   e. Nesbitt, Paul H., Alonzo W. Pond, William H. Allen. The Survival Book. Nostrand Co., 1959
   f. Ormond, Clyde. Complete Book of Outdoor Lure. Harper Row, 1959
   g. Red Cross: United States American National Red Cross. First Aid Text for Juniors. Doubleday, 1953
   h. Weels, Virginia L., Phyliss E. Kempton. Know Alaska's Mushrooms. University of Alaska Cooperative Extension Service, United States Department of Agriculture. Publication No. 6. Washington: Government Printing Office

IX. UNIDENTIFIED FLYING OBJECTS

A. The child should be able to:

1. Become aware of the phenomenon of U.F.O.'s

2. Speculate as to what are the causes of U.F.O.'s

B. Suggested Activities

1. Write a story theorizing on the origin and purpose of U.F.O.'s

2. Read magazine articles about U.F.O.'s and give reports

C. Teaching Aids Bibliography

1. Books
   a. Soule, Gardner. UFO's and IFO's: A Factual Report on Flying Saucers. Putnam, 1967

X. CAREERS

A. The child should be able to list various occupations connected with the aerospace industry.

B. Suggested activities might include making a chart with drawings of the various occupations vital to aviation.

C. Teaching Aids Bibliography

1. Filmstrips
   a. Aviation-Where Career Opportunities are Bright. NASA
   b. General Aviation Story. FAA Film Library
   c. Introduction to Aerospace. CAP Library
   d. Jet Age Flight. Society for Visual Education
   e. Looking Ahead. Piper Aircraft

2. Films 16 MM
   a. Ready for Flight. Modern Talking Pictures, color, 28 min.
   b. Stewardess Story. Modern Talking Pictures, color, 20 min.

3. Books
   a. Coombs, Charles. Aerospace Pilot. Morrow Press, 1964
   b. Hyde, Wayne. What Does a Parachutist Do? Dott, 1960
   c. Richter, Ed. The Making of a Pilot. Westminster, 1962
   d. Saunder, Keith. So You Want to Be an Airline Stewardess. Arco, 1967
   e. Schneider, Leo and Maurice U. Ames. Wings In Your Future. Harcourt, 1960
   f. Scribner, Captain Kimball J. Your Future as a Pilot. Richards Rosen Press, 1968

XI. HISTORY OF AVIATION

A. The child should be able to:

1. Tell what the following have contributed to aviation:
   a. Leonardo da Vinci
   b. Sir George Cayley
   c. Wilbur and Orville Wright

d. Charles Lindbergh
e. Otto and Gustav Lilienthal
f. Others

2. Identify the following as pioneers in Alaskan aviation:
   a. Robert Reeve
   b. Archie Fergueson
   c. Noel and Sig Wien
   d. Ben Eielson
   e. Jack Jefford

B. Suggested Activities

1. Read biographies of early day pilots

2. Collect pictures of early day planes. Display them on bulletin boards.

3. Visit an aviation museum

C. Teaching Aids Bibliography

1. Filmstrips
   a. Story of Flight--Cornet
   b. Wright Brothers--Jam Handy
   c. Pioneers of Space--Eyegate
   d. Man Learns to Fly--Encyclopedia Britannica

2. Films 16 MM
   a. Air Age. McGraw Hill, color, 26 min.
   b. First Flight of the Wright Brothers. Associated Films, b/w, 27 min.
   c. History of Aviation. Associated Film, color, 18 min.

3. Books
   a. Bohrer, Walt and Ann. Twenty Smiling Eagles. Vantage, 1962
   b. Coombs, Charles. Bush Flying in Alaska. Morrow, 1961
   c. DeLeeuw, Hendrik. From Flying Horse to Man on the Moon. St. Martins, 1963
   d. Donovan, Frank. The Early Eagles. Dodd, 1962
   e. Gardner, Jeanne L. Sky Pioneers: Story of Wilbur and Orville Wright. Harcourt, 1963
   f. Joseffy, Alvin. The American Heritage: History of Flight. Simon, 1962

g. Kaufman, Mervyn D. The Wright Brothers. Garrard, 1964
h. Lindbergh, Anne Morrow. North to the Orient. Harbrace, 1935
i. Lindbergh, Charles. We. Putnam, 1936
j. Lindbergh, Charles. Spirit of St. Louis. Scribner, 1936
k. Myers, Hortense and Burnett, Ruth. Carl Ben Eielson: Young Alaskan Pilot. Campbell, 1960
l. Schwartzkopf, Karl Aage. Arctic Pilot. Watts, 1962
m. Toland, John. Flying Tigers. Random, 1963
n. Verne, Jules. Around the World in Eighty Days. Dodd, Mead, 1956
o. Wright, Orville. How We Invented the Airplane. McKay, 1953

SECONDARY AEROSPACE GUIDELINES

INTRODUCTION

The following outline attempts to provide a framework for a general Aerospace course at the secondary level. Additionally, sections or topics may be utilized as the basis for units in other courses such as science, economics, history, etc..

I. HISTORY OF AVIATION AND SPACE EXPLORATION

A. The Antecedents and Early Beginnings of Aviation and the Advent of Space Explorations.

1. A look at the pioneers of Alaskan Aviation

2. The pioneers' contribution

3. The developments that have led to the present impact of aerospace technology on the world and Alaska

II. VEHICLES

A. Aircraft Today

1. The modern aircraft
   a. component parts
   b. differences in design and purpose
   c. basic terms and ideas related to flight and propulsion
   d. general capabilities of current commercial models
   e. familiarization with aircraft to the extent of being able to identify and describe each

2. Theory of aircraft flight
   a. a study of aerodynamic forces as related to atmospheric properties
   b. examination of the structure of the aircraft
   c. central mechanisms
   d. characteristics of flight
   e. introduction to aircraft instruments and their functions

3. Propulsion systems of aircraft
    a. examination of the factors influencing flight through propulsion
    b. fuels
    c. mancines
    d. component sections of reciprocating engines
    e. jet engines
    f. rockets
    g. functional systems as they relate to propulsion

B. Spacecraft and Launch Vehicles

1. Rockets of today and tomorrow
    a. terminology and principles of rocketry
    b. rockets and missiles now in use
    c. study of current and recent space flights
    d. study of projected space flights

2. Propulsion, guidance and control of space vehicles
   A semi-technical study of two basic essentials of Space terminology
    a. examination of the generally used propulsion systems
    b. futuristic overview of more sophisticated systems
    c. an orderly progression from simple to more complex systems of guidance control
    d. attention to the facilities and organizations involved

3. Manned and unmanned flight
    a. study capabilities and restrictions characterizing man in relationship to the total problem of conquest of space
    b. analyze state of development of the U.S. space program
        (1) determine degree, progress and implications for the future
    c. careful review of area of peaceful scientific exploration and probes into space

III. PHYSICAL FACTORS

A. Weather

1. Atmospheric components and phenomena as applied to meteorology and aeronautics

2. Nature of forecasting and its importance to aviation

3. Evolution of weather technology

B. Navigation

1. Explore the use of maps, charts and various forms of projections - basic navigation tools

2. Pilotage
   a. dead reckoning
   b. radio navigation - problems introduced and solved

3. Role of federal government in providing navigational and communication aids

C. Space and the Universe

1. Space geography and associated terminology and concepts

2. Study neighbors of the earth

3. Ideas for future space travel

D. Space Biology

1. Detailed study of physiological aspects of aviation

2. Training requirements, selection procedures and projected needs of astronaut program

3. Study of closed environmental systems
   a. physical and psychological requirements

IV. SOCIOECONOMIC FACTORS

A. Major Implications

1. Inpact of aircraft and spacecraft upon people of U.S. and the world
   a. changes in society and economy-especially in Alaska
   b. effects upon education
   c. geography
   d. science
   e. communication
   f. commerce
   g. security
   h. everyday life

B. Vocational Factors

1. Opportunities in aerospace
    a. vocational
    b. educational
    c. civilian and government careers
    d. nature of military obligations
    e. job requirements and opportunities in Alaska

C. The Significance of Communication Satellites and Similar Developments for Alaska

D. International Space Programs

1. Implications
    a. application of space technology
    b. military application of current and future space programs
    c. international law

E. Aerospace Industry

1. Scope and breadth
    a. personnel
    b. functions
    c. financial
    d. products
    e. plant locations
    f. industrial trends

2. Focus of this study
    a. recognition - aerospace power combined result of contributions from all forces
    b. review of research potential, activities
    c. examination of new and projected aircraft developments

F. Civil Aviation

1. Examination of civil air
    a. facilities
    b. development and utilization
    c. air carrier organizations - scheduled and non-scheduled airlines
    d. air taxies
    e. charter operations - emphasis on Alaska
        (1) agricultureal, business, recreation
        (2) problems of scheduling
        (3) safety
        (4) sales

(5) tariffs
(6) engine overhauls
(7) franchises
(8) personnel
(9) long range problems

V..MISCELLANEOUS

A. Non-flying Recreation

1. Radio-controlled model airplanes

2. Sky diving

B. Survival and Safety

1. Principles of survival and safety as applied to the other aspects of Alaskan life

2. Study of edible plants

3. Star navigation

C. U.F.O.'s

1. Recent authoratative findings

2. Range of interesting articles

SECONDARY AVIATION SCIENCE

SUGGESTED COURSE OUTLINE

Following is a suggested outline for a Secondary Aviation Science course based on the Federal Aviation Agency Private Pilot written examinations and the use of light aircraft in the State of Alaska. It is offered for use in schools that have the available facilities and qualified instructors, and which desire to teach such a course. The minimum qualifications of the instructor shall be that of Private Pilot or FAA rated Ground School Instructor.

I AERODYNAMICS

- A. Aircraft Components
- B. Forces
- C. Engines
- D. Propellers
- E. Axes
- F. Systems
  - 1. Fuel
  - 2. Electrical
  - 3. Static Air

II. INSTRUMENTS

- A. Engine
- B. Flight
- C. Gyro

III. METEOROLOGY

- A. U.S. Weather Bureau

B. Weather advisory services

C. Air masses
    1. Clouds
    2. Icing
    3. Turbulence

IV. NAVIGATION

A. Map construction

B. Charts
    1. Planning aids
    2. Computer
    3. Plotter

C. Pre-trip planning
    1. Flight plan
    2. VOR
    3. ADF
    4. LF/MF Range

V. ALASKAN GEOGRAPHY

A. Mountain ranges
    1. Major peaks
    2. River systems

B. Major water bodies

C. Other significant topographical features

VI. RADIO COMMUNICATIONS

A. Licensing

B. High frequency, very high frequency

C. Facilities

D. Phraseology
    1. Phonetic alphabet

VII. AIRCRAFT OPERATIONS AND PERFORMANCE

A. Vee speeds

B. Koch chart

C. Weight and balance

VIII. FEDERAL AIR REGULATIONS

A. Part 61
   1. Subpart B, A, C

B. Part 62
   1. Subpart B

C. Part 91
   1. Subparts A,B,C

IX. SURVIVAL

X. CAREER OPPORTUNITIES

PERIODICALS

The AOPA Pilot, 4650 East-West Highway, Bethesda, Maryland 20014

Private Pilot Magazine, Van Nuys, California

Air Progress, Conde Nast Publications, 420 Lexington Avenue, New York, New York 10017

Plane and Pilot, Warner & Warner Corp., 631 Wilshire Blvd., Santa Monica, California

Anyone Can Fly, Bergman, Jules, Doubleday and Co., 277 Park Avenue New York, New York 10017

Modern Airmanship, Neil D. Van Sickle, Jeppessen & Co. 8025 East 40th Avenue, Denver, Colorado 80207

You Fly It, James Joseph Dodd, Mead & Co., 79 Madison Avenue New York, New York 10016

Who, Me Fly'?, Robert Scharff, Tower Publications, Inc. 185 Madison Ave., New York, New York 10016

Ground to Flight, Route 2, Box 290, Wayzata, Minnesota 55391

Jeppesen Basic Aeronautics Course, Jeppesen & Co., 8025 East 40th Avenue, Denver, Colorado 80207

How You Can Forecast the Weather, Eric Sloane, Fawcett Publications, Inc. Greenwich, Connecticut

The New Private Pilot, Pan-American Navigation, 12021 Ventura Blvd., North Hollywood, California 91604

Ground Instructor Ratings: Basic, Advanced, Instrument, Pan American Navigation, 12021 Ventura Blvd., North Hollywood, California 91604

Private Pilots' Handbook of Navigation, James & Gene Elliott, Aero Publishers, Inc., 329 Aviation Rd., Fallbrook, California 92028

Aviation Radio for Pilots, Holahan, James, Crown Publishers, 419 Park Ave. South, New York, New York 10016

Practical Air Navigation, Jeppessen

Anvil of the Gods, Fred McClement, J.B. Lippincott Co.,
East Washington Square, Philadelphia, Pa., 19105

Meterology for Airmen, Pan American Navigation Service

SOURCES OF AEROSPACE EDUCATIONAL MATERIALS

Aerospace Industries Association
1725 Desales St., NW
Washington, D. C. 20036

Beech Aircraft Corporation
Aviation Education Dept.
Wichita, Kansas 67201

Cessna Aircraft Company
Air Age Education
P.O. Box 1521
Wichita, Kansas 76201

Civil Air Patrol
National Headquarters
c/o Bookstore
Maxwell Air Force Base, Ala. 36112

Department of the Army
Director, Audio-Visual Support Center
Fort Richardson, Alaska 98749

Department of the Navy
Audio-Visual Branch
Office of Information
Washington, D. C. 20350

Federal Aviation Administration
Aviation Education
G-A-20 Office of General Aviation Affairs
Department of Transportation
Washington, D. C. 20590

F.A.A. Film Library
AC-921
P.O. Box 25082
Oklahoma City, Okla. 73125

F.A.A. Free Publications
F.A.A. Bldg. Boeing Field
Seattle Washington 98108

Jam Handy Organization
2821 E. Grand Ave. Blvd.,
Detroit, Michigan 48211

Jeppessen and Co.
8025 E. 40th Ave.,
Denver, Colorado 80207

Lockheed-Georgia
Motion Picture Film Library
Zone 30, B-2 Bldg.,
Marietta, Georgia 30060

Mobile Oil Corporation
Aviation Department
150 East 42nd St.,
New York, New York 10017

National Aeronautics and
Space Administration
NASA Film Library
FAD-2
Washington, D. C. 20546

National Aeronautics and Space Administration
(for educational material)
NASA Ames Research Center
Moffett Field, California 94035

National Aerospace Education Council
806 15th St. N.W.
Room 616
Washington, D. C. 20005

National Association of Rocketry
1239 Vermont Avenue., N.W.
Washington, D. C. 20005

Pan American World Airways
Pan Am Bldg.,
c/o Educational Services
New York, New York 10017

Sanderson Films, Inc.
P. O. Bos 13121
Wichita, Kansas 67213

Shell Oil Company
430 Peninsular Ave.
San Mateo, California 94401

Sikorsky Aircraft
Stratford, Connecticut 06514

Space Publications
1341 G. St., N. W.
Washington, D. C. 20005

Trans World Airlines
605 Third Avenue
New York, New York 10016

U.S. Air Force Film Library Center
8900 So. Broadway
St. Louis, Missouri 63125

United Airlines
School and College Services
Box 8776
Chicago, Illinois 60666

United Training Aids, Inc.,
2541 Bobwhite
Wichita, Kansas 67204